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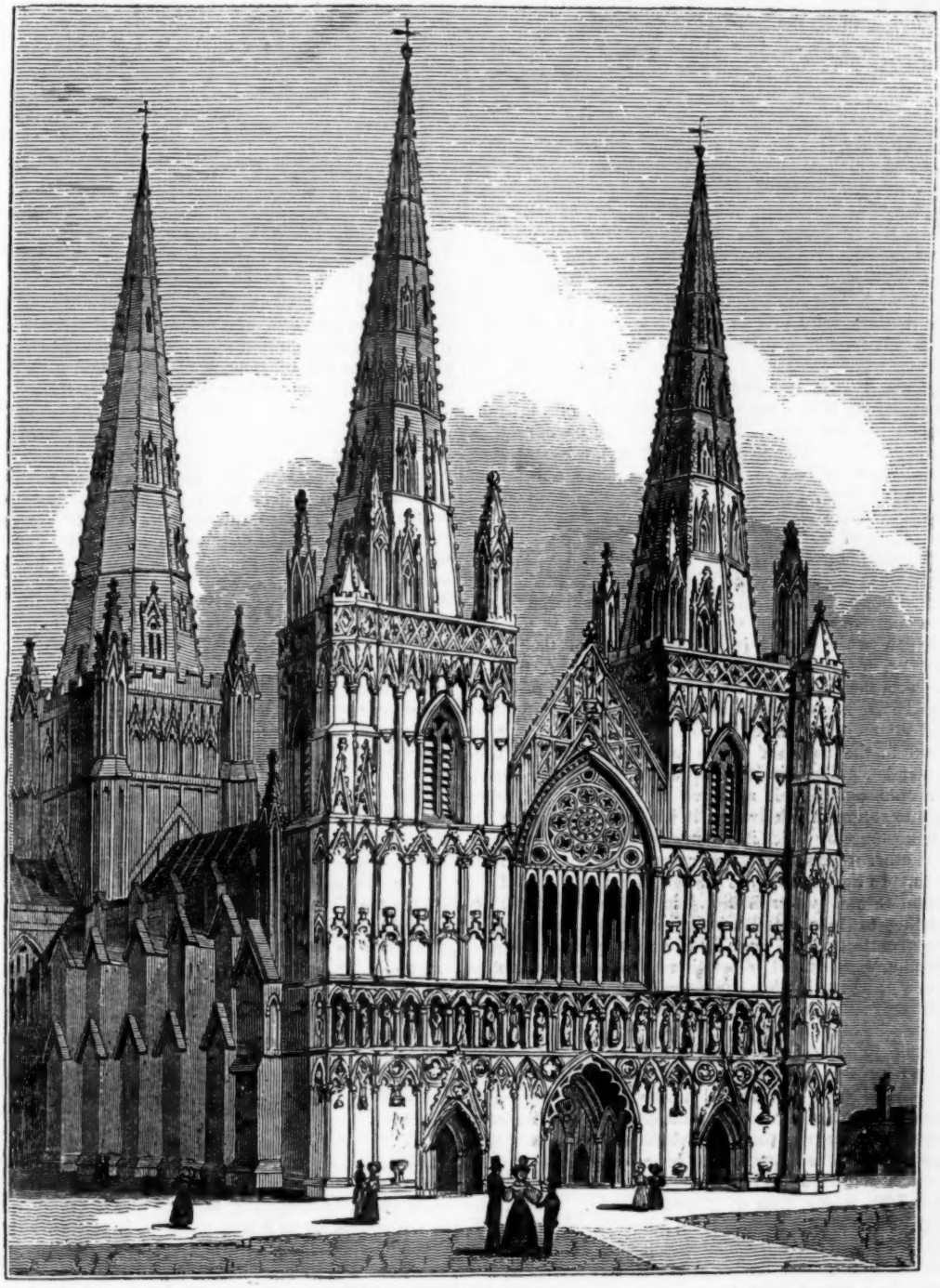
THE CATHEDRAL OF LICHFIELD.



[West Front of Lichfield Cathedral.]

The Cathedral of Lichfield has no pretensions to vie in architectural grandeur with that of York and several others in England; but it is not without considerable beauties, both in its external appearance and in its interior. It makes no great show when seen from a distance; but it possesses one advantage, in which it is

almost singular among such buildings in this country, namely, the open space which it has to a considerable distance around it, enabling the spectator to obtain from the immediate neighbourhood nearly a perfect view of it on every side. It stands on a spot which is elevated above the rest of the city, and surrounded by a wall which in former times was fortified, in imitation of the manner in which convents and other ecclesiastical possessions used often, in France and other foreign countries, to be secluded and converted into a sort of forts, or strong-holds. This portion of the city of Lichfield is still known by the name of the *Close*, just as in old Paris there were the *Clos* of the Augustines, the *Clos* of the Jacobins, &c. The Close contains a considerable number of houses besides the cathedral; but they neither crowd upon the sacred edifice, as they do in most other cities, nor are they of so mean a description as to present a disagreeable or unsuitable contrast in its vicinity. Some old trees ornament the northern side of the lawn, in the midst of which the cathedral stands, which, together with a sheet of water on the opposite side, give something of a rural air to the place.

The cathedral does not stand due east and west, as is usual with sacred buildings, but varies from the right line by an angle of about twenty-seven degrees, or not much less than the third part of a whole quarter of the compass. It is built in the customary form of a cross, the principal bar containing the nave of the church, the choir, and what is called the Lady Chapel. The extreme length is 403 feet; the shorter bar, or the transept, is 177 feet long. The width of the nave inside is about 66 feet. The principal front is the west. It is surmounted by two pyramidal spires; and a third, of the same form, rises from the centre of the building. The former are each 192 feet high; the latter rises to the height of 252 feet.

If tradition may be trusted, the spot on which Lichfield stands has a claim to be regarded as one of the most sacred in our island. Here it is said a thousand Christian martyrs were put to death at one time, in the persecution which raged in the beginning of the fourth century, under Dioclesian and Maximian. A field in the neighbourhood, which still bears the name of Christian Field, is pointed out as the scene of this slaughter; and etymologists have found a memorial of the same event in the name of the town itself. Lichfield, they contend, signifies, in Saxon, the Field of the Dead. Dr. Johnson, himself a native of Lichfield, has taken care to record this derivation in his Dictionary, with the circumstance by which it is supposed to be countenanced. But other writers have given other interpretations of the term. In the Saxon times Staffordshire was a part of the extensive and powerful kingdom of Mercia, which, according to Bede, was Christianized about the middle of the seventh century, upon its conquest by Oswy, king of Northumberland. Lichfield is said to have been erected into a bishopric in 656; the person first appointed to preside over the see being named Diuma. His immediate successors were Cellach, Trumhere, Jaruman, and Ceadda, commonly called St. Chad, who was consecrated in 669, and held the bishopric for two years. He obtained great renown on account of his piety, and for many ages after his death a miraculous atmosphere was believed to surround even the tomb that held his remains. The first cathedral is supposed to have been begun by his predecessor, Jaruman; but it was not completed till the year 700, in the time of Bishop Hedda. About the end of the eighth century the influence of King Offa obtained from the Pope the erection of Lichfield into an archbishopric; but it did not retain this dignity for more than two or three years. The diocese was originally one of great extent, comprehending nearly the half of England; but several other bishoprics have been formed out of it in later times. The diocesan used to style himself sometimes Bishop of Lichfield, sometimes of Coventry, having a cathedral, a palace, and a chapter in each city, till at last the common form came to be Bishop of Coventry and Lichfield. Bishop Hacket, who was appointed to the see immediately after the Restoration, changed the order of the two names; and the designation of the diocese ever since has been the Bishopric of Lichfield and Coventry.

The founder of the present cathedral is usually stated to have been Roger de Clinton, who came to the see in 1128. But the style of architecture indicates that very little of what now remains could have been erected by him. Mr. Britton is of opinion that it must have been mostly built in the course of the thirteenth and fourteenth centuries. Fuller tells us, in his Church History, that it was completed in the time of Bishop Heyworth, who came to the see in 1420. No documents, or hardly any, referring to its erection exist: all its records were destroyed either at the time of the Reformation, or during the civil wars in the seventeenth century. On the former occasion it was despoiled of all its ornaments which could be easily converted into another use; its richly decorated shrines and gold and silver vessels being all confiscated to the crown. At the commencement of the civil war the Close of Lichfield was fortified by the royalists, and the command intrusted to the Earl of Chesterfield. In March, 1643, the garrison here was attacked by Robert Greville, Lord Brooke, a zealous puritan, who is said to have endeavoured to invoke the aid of Heaven by a vow, that if he should succeed in his attempt he would level the cathedral with the ground. But on the 2d of the month, which happened to be St. Chad's day, and therefore, we may well believe, made the circumstance seem to many a very remarkable judgment, his lordship was shot dead as he walked along the street below, by a gentleman stationed on the great tower of the church. The garrison, however, were obliged to surrender on the third day after, when the parliamentary soldiers entered and took possession of the place. These followers of Lord Brooke did not quite throw down the cathedral, but they inflicted upon it both desecration and injury to no small extent. They exercised their barbarism, says Dugdale, ('Short View of the Late Troubles,') "in demolishing all the monuments, pulling down the curious carved work, battering in pieces the costly windows, and destroying the evidences and records belonging to that church; which being done, they stabled their horses in the body of it; kept courts of guard in the cross aisles; broke up the pavement; * * * and every day hunted a cat with hounds throughout the church, delighting themselves in the echo from the goodly vaulted roof." The parliamentary forces kept possession of the Close till the 21st of April, when they were again driven out by the royalists. It remained in the hands of the latter till July, 1646; when it was once more attacked, and compelled to admit a new garrison, after a brief resistance. The cathedral suffered greatly from these successive sieges. It was reckoned that no fewer than two thousand cannon-shot and one thousand five hundred hand grenades had been discharged against it; and the effect was that the three spires were nearly entirely battered down, and hardly any thing left standing except the walls. Even they were every where defaced and mutilated.

The restorer of the building was the excellent Bishop Hacket, already mentioned as having been appointed to the see after the return of Charles II. In the course of eight years, by unsparing exertion and liberality, he had succeeded, as far as it was possible, in repairing the sad devastations of the preceding quarter of a century. The structure has since, however, undergone considerable alterations at various times; and in particular about the close of the last century it received a complete renovation under the direction of the late Mr. Wyatt.

The finest parts of Lichfield Cathedral are the west front, which is very rich and splendid, and the Lady

Chapel, the painted glass in the windows of which, brought from the chapel of the nunnery of Herckenrode, in Liege, may probably vie with any thing of the kind in this country. The church contains a considerable number of tombs, but few of them interesting from their antiquity. Among those of modern date are one to the memory of Dr. Johnson, and another to that of Lady Mary Wortley Montague, who was also a native of Lichfield. There is also one in commemoration of the two female children of the Rev. W. Robinson, which is one of Chantrey's very finest works. For further information on the subject of the cathedral, the reader may consult Mr. Britton's History of its Architecture and Antiquities, Jackson's History of Lichfield, and Shaw's History of Staffordshire.

THEORY AND PRACTICE.

[From the American Quarterly Review.]

The science of political economy, like other sciences, is a collection of general truths and principles, deduced from an extensive and accurate observation and collation of facts—not the limited experience of a single individual—but the extended experience of nations; not the facts of a single district or of one age, imperfectly observed and falsley reasoned from by an unformed mind—but facts from all countries and many centuries, diligently and minutely analyzed and compared, and the principles and truths deduced by many able men, whose minds, stored with various knowledge, accustomed to investigation, and trained to the art of reasoning, were devoted intensely, for years, to the subject. But there seems at the present day, even among persons sufficiently enlightened upon other matters, a great rage for what is called "practical knowledge"—a term difficult to define, but which, from the way in which it is generally used, appears to be synonymous with intuitive knowledge.

The professors of this species of knowledge term themselves "practical men," and seem to be of opinion that there is not *any* thing in heaven or earth not circumscribed within the limits of their philosophy. What they *see*, they believe—the facts of their own experience, the events which are passing around them, are the data upon which they build *their* theories; and their imperfect and confused deductions, from scanty and inaccurately observed facts, are by the vanity of ignorance preferred to the discoveries of science, and the conclusions of reason. "Practical knowledge" is, by these philosophers, opposed to theoretical knowledge. Theoretical appears, in their vocabulary, to mean any thing that is written in a regular methodical manner—and practical knowledge, the information gained, and the conclusions drawn from individual observation, and from reading newspapers and speeches in Congress.

It ought to be more generally known, that theory is nothing more than the conclusions of reason from numerous and accurately observed phenomena, and the deduction of the laws which connect causes with effects;—that practice is the application of these general truths and principles to the common affairs and purposes of life; and that science is the recorded experience and discoveries of mankind, or, as it has been well defined, "the knowledge of many, orderly and methodically digested and arranged, so as to become attainable by one."

Every man who observes a phenomenon, and attempts to account for it, or draws a conclusion from its occurrence, is guilty of theorizing. The "practical man," however, goes no further than the fact before him—he gives a reason for its occurrence, if he can, which not being capable of further application, and not comprehending any other facts, even if it be correct, is comparatively useless. The scientific man, not content with observing one fact, collects many, and by discovering their points of resemblance, and tracing the chain of causes and effects, arrives at a general principle or law, capable of extensive application and varied usefulness.

A "practical man" sees the lid forced off from a vessel of water, when the water is heated; if he attempts to give a reason, he says, that it was because the steam could not escape, and he resolves the next time to leave it a vent. The philosopher, from this phenomenon, is led to the examination of others, and through a train of investigation and discovery which terminates in the steam-engine.

The "practical man" goes to market in the morning, and always finds as many commodities as he wishes to purchase. If he thinks about so ordinary an occurrence, he supposes, very justly, that the owners of the commodities come to market because they expect to meet purchasers, and that they sell their goods, because they prefer having his money. A scientific man, from this phenomenon, and from a careful analysis of it and analogous facts, discovers the true principles which regulate demand and supply, with all their important results.

A "practical man" is told by his neighbour that he intends to withdraw from the business in which he is engaged, and invest his capital in another, where he has good reason to expect more profit. He commends the prudence of his friend, and perhaps looks closer to his own affairs. The scientific man, upon being told the like thing, meditates a little more deeply, and reasoning from particulars to generals, arrives at length at the conclusion that the industry of a country will be most productive when least interfered with.

The "practical man," if he happens to live near a manufactory, upon the introduction of an improvement in machinery, whereby the work formerly performed by six men can now be done by two, sees a number of poor labourers thrown out of employment, and a number of families reduced to want. He is induced to suppose that labour-saving machinery is an evil, and productive of poverty and wretchedness—and if he is a passionate man as well as a practical one, he thinks the workmen would serve their employers right by destroying the machines. The scientific political economist, on the contrary, from the examination and comparison of many facts, and from a train of comprehensive and accurate reasoning, is convinced, that notwithstanding the partial and transient evil caused by their introduction, every improvement in machinery by which the cost of production is diminished, is a permanent advantage to *all* classes of society.

Stage-Coaches.—The public have now been so long familiarized with stage-coach accommodation, that they are led to think of it as having always existed. It is however, even in England, of comparatively recent date. The late Mr. Andrew Thomson, sen., told me, that he and the late Mr. John Glassford went to London (from Glasgow) in the year 1739, and made the journey on horseback. Then there was no turnpike-road till they came to Grantham, within one hundred and ten miles from London. Up to that point they travelled on a narrow causeway, with an unmade soft road upon each side of it. They met from time to time strings of pack-horses, from thirty to forty in a gang, the mode by which goods seemed to be transported from one part of the country to another. The leading horse of the gang carried a bell to give warning to travellers coming in an opposite direction; and he said, when they met these trams of horses, with their packs across their backs, the causeway not affording room, they were obliged to make way for them, and plunge into the side road, out of which they sometimes found it difficult to get back again upon the causeway.

[An extract from Mr. D. Bannatyne's Scrap-Book, as given in Dr. Cleland's Statistical Account of Glasgow.]

THE POLAR BEAR.

[Polar Bears and Seal.]

In those desolate fields of ice which lock up the polar seas during a great part of the year, the White Bear (the *Ursus Maritimus* of Linnæus) finds an abode congenial to his hardy nature. Prowling over the frozen wastes, he satiates his hunger on the marine animals, such as seals, who break through the ice to breathe the open air; or he plunges into the sea in pursuit of his prey. Possessing an astonishingly acute scent, great activity and strength, and equal cunning, he contrives to support existence in regions where it might be thought that so large a quadruped must necessarily perish. Ever watchful, he ascends the hills of ice, called hummocks, to extend his range of observation over the wide plain where a solitary seal may perhaps be resting; or to snuff the tainted air, by which he knows that some remains of a whale, or a walrus (sea-horse), deserted by the fishermen of Europe or the native Eskimaux, will afford him an ample feast. He doubtless often suffers long and extreme hunger; for the seal, which forms his chief subsistence, is as vigilant as the bear; and he is often carried out to sea upon some small island of ice, where he may remain for days without the possibility of procuring food. The Polar Bear has been seen floating in this way at a distance of two hundred miles from any land. Swimming excellently, he, however, often travels from one island of ice to another; or visits the shore, where he commits fearful ravages. In Iceland, where these destructive animals sometimes land, the inhabitants immediately collect together to destroy them. Near the east coast of Greenland, according to Captain Scoresby, in his account of the Arctic Regions, they have been seen on the ice in such quantities, that they were compared to flocks of sheep on a common.

In the Zoological Gardens there is a polar bear, from which the representation of one in the preceding wood cut was taken. In the British Museum there is a stuffed specimen of considerably larger dimensions. The animal is ordinarily from 4 to 5 feet high, and from 7 to 8 feet long, weighing from 600 lbs. to half a ton. Barentz, an early voyager in these regions, killed two enormous white bears in 1596, the skin of one of which measured 12 feet, and that of the other 13 feet. The cubs of this powerful animal are, however, not larger than rabbits. Hearne, a traveller of great authority, states that he has seen their foot-prints on the snow not larger than a crown-piece, when the impression of their dam's foot measured 14 inches by 9.

The polar bear generally retreats from man; but when attacked he is a formidable enemy. Captain Scoresby, in his Voyage to Greenland, gives several interesting anecdotes, which strikingly exhibit the power and courage of the animal. Our readers will be grati fied by these extracts:—

"A few years ago, when one of the Davis's Strait whalers was closely beset among the ice at the 'south-west,' or on the coast of Labrador, a bear that had been for some time seen near the ship, at length became so bold as to approach alongside, probably tempted by the offal of the provision thrown overboard by the cook. At this time the people were all at dinner, no one being required to keep the deck in the then immoveable condition of the ship. A hardy fellow who first looked out, perceiving the bear so near, imprudently jumped upon the ice, armed only with a handspike, with a view, it is supposed, of gaining all the honour of the exploit of securing so fierce a visitor by himself. But the bear, regardless of such weapons, and sharpened probably by hunger, disarmed his antagonist, and seizing him by the back with his powerful jaws, carried him off with such celerity that on his dismayed comrades rising from their meal

and looking abroad, he was so far beyond their reach as to defy their pursuit."

"A circumstance communicated to me by Capt. Munroe of the Neptune, of rather a humorous nature as to the result, arose out of an equally imprudent attack made on a bear, in the Greenland fishery of 1820, by a seaman employed in one of the Hull whalers. The ship was moored to a piece of ice, on which, at a considerable distance, a large bear was observed prowling about for prey. One of the ship's company, emboldened by an artificial courage, derived from the free use of rum, which in his economy he had stored for special occasions, undertook to pursue and attack the bear that was within view. Armed only with a whale-lance, he resolutely, and against all persuasion, set out on his adventurous exploit. A fatiguing journey of about half a league, over a yielding surface of snow and rugged hummocks, brought him within a few yards of the enemy, which, to his surprise, undauntedly faced him, and seemed to invite him to the combat. His courage being by this time greatly subdued, partly by evaporation of the stimulus, and partly by the undismayed and even threatening aspect of the bear, he levelled his lance, in an attitude suited either for offensive or defensive action, and stopped. The bear also stood still; in vain the adventurer tried to rally courage to make the attack; his enemy was too formidable, and his appearance too imposing. In vain also he shouted, advanced his lance, and made feints of attack; the enemy, either not understanding or despising such unmanliness, obstinately stood his ground. Already the limbs of the sailor began to quiver; but the fear of ridicule from his messmates had its influence, and he yet scarcely dared to retreat. Bruin, however, possessing less reflection, or being regardless of consequences, began, with audacious boldness, to advance. His nigh approach and unshaken step subdued the spark of bravery and that dread of ridicule that had hitherto upheld our adventurer; he turned and fled. But now was the time of danger; the sailor's flight encouraged the bear in turn to pursue, and being better practised in snow-travelling, and better provided for it, he rapidly gained upon the fugitive. The whale-lance, his only defence, encumbering him in his retreat, he threw it down, and kept on. This fortunately excited the bear's attention; he stopped, pawed it, bit it, and then renewed the chase. Again he was at the heels of the panting seaman, who, conscious of the favourable effects of the lance, dropped one of his mittens; the stratagem succeeded, and while Bruin again stopped to examine it, the fugitive, improving the interval, made considerable progress a-head. Still the bear resumed the pursuit with a most provoking perseverance, except when arrested by another mitten, and finally, by a hat, which he tore to shreds between his fore-teeth and paws, and would, no doubt, soon have made the incautious adventurer his victim, who was now rapidly losing strength, but for the prompt and well-timed assistance of his shipmates—who, observing that the affair had assumed a dangerous aspect, sallied out to his rescue. The little phalanx opened him a passage, and then closed to receive the bold assailant. Though now beyond the reach of his adversary, the dismayed fugitive continued onwards, impelled by his fears, and never relaxed his exertions until he fairly reached the shelter of his ship. The bear once more came to a stand, and for a moment seemed to survey his enemies with all the consideration of an experienced general; when, finding them too numerous for a hope of success, he very wisely wheeled about, and succeeded in making a safe and honourable retreat."

The sagacity of the polar bear is well known to the whale fishers. They find the greatest difficulty in entrapping him, although he fearlessly approaches their vessels. The following instances of this sagacity are very curious:—

"A seal lying on the middle of a large piece of ice, with a hole just before it, was marked out by a bear for its prey, and secured by the artifice of diving under the ice, and making its way to the hole by which the seal was prepared to retreat. The seal, however, observed its approach, and plunged into the water; but the bear instantly sprung upon it, and appeared, in about a minute afterwards, with the seal in its mouth.

"The captain of one of the whalers being anxious to procure a bear, without wounding the skin, made trial of the stratagem of laying the noose of a rope in the snow, and placing a piece of kreng within it. A bear, ranging the neighbouring ice, was soon enticed to the spot, by the smell of burning meat. He perceived the bait, approached, and seized it in his mouth; but his foot, at the same moment, by a jerk of the rope, being entangled in the noose, he pushed it off with the adjoining paw, and deliberately retired. After having eaten the piece he carried away with him, he returned. The noose, with another piece of kreng, being then replaced, he pushed the rope aside, and again walked triumphantly off with the kreng. A third time the noose was laid; but, excited to caution by the evident observation of the bear, the sailors buried the rope beneath the snow, and laid the bait in a deep hole dug in the centre. The bear once more approached, and the sailors were assured of their success. But Bruin, more sagacious than they expected, after snuffing about the place for a few moments, scraped the snow away with his paw, threw the rope aside, and again escaped unhurt with his prize."

The female polar bear is as fierce in her hostility as the male; but nothing can exceed the affection which she feels for her young. The difficulty of procuring food for them, and the hardships to which they are exposed, no doubt call forth this quality. Some of the instances upon record are as singular as they are affecting. The following is related in one of the Polar Voyages:—

"Early in the morning, the man at the mast-head gave notice that three bears were making their way very fast over the ice, and directing their course towards the ship. They had probably been invited by the blubber of a sea-horse, which the men had set on fire, and which was burning on the ice at the time of their approach. They proved to be a she-bear and her two cubs; but the cubs were nearly as large as the dam. They ran eagerly to the fire, and drew out from the flames part of the flesh of the sea-horse, which remained unconsumed, and ate it voraciously. The crew from the ship threw great pieces of the flesh, which they had still left, upon the ice, which the old bear carried away singly, laid every piece before her cubs, and dividing them, gave each a share, reserving but a small portion to herself. As she was carrying away the last piece, they levelled their muskets at the cubs, and shot them both dead; and in her retreat, they wounded the dam, but not mortally.

"It would have drawn tears of pity from any but unfeeling minds, to have marked the affectionate concern manifested by this poor beast, in the last moments of her expiring young Though she was sorely wounded, and could but just crawl to the place where they lay, she carried the lump of flesh she had fetched away, as she had done the others before, tore it in pieces, and laid it down before them; and when she saw they refused to eat, she laid her paws first upon one, and then upon the other, and endeavoured to raise them up. All this while it was piteous to hear her moan. When she found she could not stir them, she went off, and when at some distance, looked back and moaned; and that not availing to entice them away, she returned, and smelling around them, began to lick their wounds. She went off a second time, as before, and having crawled a few paces, looked again behind her, and for some time stood moaning. But still her cubs not rising to follow her, she returned to them again, and with signs of inexpressible fondness, went round first one and then the other, pawing them, and moaning. Finding at last that they were cold and lifeless, she raised her head towards the ship, and growled her resentment at the murderers, which they returned with a volley of musket balls. She fell between her cubs, and died licking their wounds.'

MINERAL KINGDOM.—Section 5.

The subjects which it is the province of the geologist to investigate, are by no means confined to questions concerning mineral substances, but embrace a wider field, involving many considerations intimately connected with the history of several tribes of animals and plants. As it is not possible to give even a brief outline of the doctrines of geology without referring to the great orders and classes into which naturalists have divided the ani mal kingdom, before proceeding, as we proposed in the last section, to describe the divisions of the stratified

rocks which geologists have established, and which are founded mainly upon the distinctive characters afforded by the remains of organized bodies contained in the different strata, it will be necessary to say a few words upon the classification of animals, in order to render the terms we must employ more intelligible to those of our readers who are unacquainted with the subject.

Animals are divided into four great branches, distinguished by the terms *Vertebrated*, *Molluscous*, *Articulated*, and *Radiated*. The FIRST DIVISION includes all those animals which are provided with a backbone; and because the smaller bones or joints of which it is composed are called by anatomists *vertebræ* (from a Latin word signifying *to turn*) the individuals that belong to this division are called *Vertebrated Animals*. It is subdivided into four classes; 1. *Mammalia*, comprehending man, land quadrupeds, and the whale tribe; that is, all animals which give suck to their young; the term being derived from *mamma*, the Latin name of that part of the body from which the milk is drawn. 2. *Birds*, of all kinds. 3. All those animals called *Reptiles* by naturalists: the word means nothing more than that they creep, and is derived from the Latin verb "to creep," but it has in common language a far more extended sense than that to which it is restricted in natural history. Frogs, serpents, lizards, crocodiles, alligators, tortoises, and turtles, are reptiles, in the sense of the word as used by naturalists. 4. *Fishes*, of all kinds, except the whale tribe, which belongs to the class *mammalia*.

The SECOND DIVISION includes tribes of animals which have no bones, and because their bodies contain no hard parts, they are called *Molluscous Animals*, from a Latin word signifying soft. But with a few exceptions they have all a hard covering or shell to which they are either attached, or in which they can enclose themselves, and be preserved from injuries to which, from their soft nature, they would otherwise be constantly exposed. There are six classes in this division, founded on certain peculiarities of anatomical structure in the animal, but these we shall not notice; for, without a much longer description than we can enter upon, it would be a useless enumeration of hard names. It will answer our present purpose much better to say, that the animals belonging to this division may be classified according to differences in the forms of their hard covering or shells, for it is the hard parts of animals which furnish the records of their former existence; these only are preserved imbedded in the strata, all traces of the flesh or other soft parts, as far as form is concerned, having entirely disappeared. MOLLUSCOUS *Animals*, therefore, are divisible into, 1. *Univalves*, that is, animals armed with a shell or valve forming one continuous piece, such as snails and whelks. 2. *Bivalves*, or those having two shells united by a hinge, such as oysters, cockles, &c. 3. *Multivalves*, or those having more than two shells, of which the common barnacle is an example.

The THIRD DIVISION is assigned to what are called *Articulated Animals*, these having a peculiar anatomical structure, called articulations, from *articulus*, Latin for a little joint. It is subdivided into four classes; 1. *Annelides*, or those having a ringed structure, from *annulus*, Latin for ring: leeches and earth-worms are examples. 2. *Crustacea*, or those which have their soft bodies and limbs protected by a hard coating or *crust*, which in common language we also call shell, such as lobsters, crabs, and prawns. 3. *Spiders*, which form a class by themselves. 4. *Insects*, such as flies, beetles, bees, and butterflies.

The FOURTH DIVISION comprehends a great variety of animals which have an anatomical structure like an assemblage of rays diverging from a common point, and from which they are called *Radiated Animals*, *radius* being Latin for ray. It contains five classes, but as three of these are animals without hard parts, we may pass them over; of the remaining two, the one contains the *echini* or sea urchins; the other, the very numerous tribe called zoophites, from two Greek words signifying animal and plant, because the animal is fixed to the ground and builds its strong habitation in the form of a shrub or branch or leafy plant. Corals and sponges belong to this class, and among all the different animal remains that are found in the strata, there is no class which bears any proportion in point either of frequency of occurrence or in quantity equal to this last.

The great divisions of animals, so far as the remains of species found in the strata are concerned, or as it is termed in a *fossil* state, are therefore briefly these:

I. Vertebrated Animals; *Classes*—Mammalia, Birds, Reptiles, Fishes.

II. Molluscous Animals; *Classes*—Univalve, Bivalve, Multivalve Shells.

III. Articulated Animals; *Classes*—Crustacea, Insects.

IV. Radiated Animals; *Classes*—Echini, Zoophites.

Each class is farther divisible into several *families*, each family into several *genera*; each genus into several *species*, according as greater or minor points of resemblance and difference bring individuals near to each other. There are certain other great distinctions which it is necessary to mention, viz. that some animals eat animal food, the *Carnivorous*; others vegetable food, the *Graminivorous*; some can live both in the air and in water, the *Amphibious*. Among fishes, molluscæ, and crustacea, some live in the sea, some in fresh water, some in both; and of those inhabiting fresh water some are peculiar to rivers, others to lakes. There are also land-shells, such as the common garden-snail. It is scarcely necessary to remind our readers that certain species are peculiar to particular regions of the earth, being adapted by their nature to the different temperature and other peculiarities that exist in different countries.

The number of distinguishable genera and species of fossil plants bears but a small proportion to that of fossil animal remains, and the notice we shall be called upon to take of them in the present brief outline of geology, is not such as to require us to enter into any previous explanation of the great divisions of the vegetable kingdom: this too we could not give so as to serve any useful purpose without entering into details that would lead us far beyond the limits to which we must restrict ourselves. We shall therefore now proceed to point out the great divisions into which the various stratified rocks have been separated, referring our readers to diagram No. 1, Section 2.

The lowest members in the order in which the stratified rocks are placed one above another, are distinguished by the great predominance of hard slaty rocks having a crystalline or compact texture, but chiefly by this circumstance, that they have not been found to contain any fragments of *pre-existing* rocks, or the remains of organized bodies. On this account they have been called the PRIMARY STRATA, as if formed prior to the existence of animal life, and as containing no evidence of other rocks having existed before them. That we cannot now discover animal remains in these strata is, however, no proof that they had not previously existed, because we meet with rocks containing organic remains which are so altered by the action of heat in those parts where they happen to have come in contact with a mass of granite or whinstone, that all traces of the organic remains are obliterated, those parts of the rocks acquiring a crystalline character analogous to what prevails in the primary strata. These last may have contained the remains of animals, but being nearest to the action of volcanic heat, they may have been so changed as to obliterate the shells and corals by their being melted as it were into the substance of the crystalline rock. The absence of the fragments of pre-existing rocks is a less questionable ground of distinction. From whence the materials composing these

primary strata were derived, is a question that it is not very likely any geological researches will enable us to solve; that they were in a state of minute division, were suspended in and gradually deposited from a fluid in an horizontal arrangement, and that they were subsequently elevated, broken, and contorted by some powerful force, prior to the deposition of the strata that lie over them, is beyond all doubt. There may also be beds of rock of great thickness, in which neither fragment nor organic remain has been found throughout a great extent of country, which nevertheless may not be primary, for if in any part of the same mass a single pebble or a single shell should afterwards be discovered, indubitably imbedded in it, one such occurrence would be as conclusive as a thousand, that a prior state of things had existed. It follows, therefore, that until the whole of an extensive district of such rocks were carefully examined, we could never be sure that they might not one day be discovered to be of secondary origin; there is nothing in the *mineral* structure of any one stratified rock that entitles us absolutely to say that other rocks and living bodies could not have existed prior to its formation. But as there are large tracts of country occupied by strata, in which neither fragments of pre-existing rocks nor organic remains have yet been discovered, geologists are justified in designating them the *primary* strata; to call them *primitive*, as they used to be, and indeed still are by some geologists, is to employ a term which expresses much more than we are entitled to assert.

The unstratified rock most usually associated with the primary strata is granite, of different varieties of composition, usually lying under them in great masses, and bursting through, forming lofty pinnacles, as in the Alps, and sometimes sending forth shoots or veins, which penetrate the superincumbent strata in all directions.

Immediately above the primary strata there commences another series, very like many of the rocks below them, in respect of mineral composition, but containing the remains of shells, and some pebbles, and interstratified with thick beds of limestone, including shells and corals. These rocks are penetrated also by granite, and, in common with the primary strata, form the great deposit of the metallic ores. They are, for want of a better term by which the class can be distinguished, usually called the *transition* strata, a name given by the elder geologists, because they were supposed to form a step or transition from the primitive state of the globe to that condition when it began to be inhabited by living bodies; in strictness they form the lowest members of the next great division of the strata, which is distinguished by the name of *the Secondary Rocks*. These will be treated of in our next section.

CRANMER.

On the 21st of March, 1556, Archbishop Cranmer underwent his death at Oxford by being burned at the stake. Thomas Cranmer was born in 1489, at Aslacton, in Nottinghamshire, of a family which is said to have come over with William the Conqueror. Having been entered of Jesus College, Cambridge, in 1503, he obtained a fellowship, but lost it on his marrying. His wife, however, having soon after died, he regained the appointment. He seems now to have made up his mind to a life of celibacy, and, applying himself to the study of divinity, commenced doctor in 1523. It was in 1529 that an accidental meeting at Waltham Abbey, in Essex, with Edward Fox, the king's almoner, and Stephen Gardiner, his secretary, occasioned his introduction to Henry VIII., then in the midst of his efforts to obtain a divorce from his first wife Catherine of Arragon. Cranmer is said to have suggested the plan of submitting the matter to the universities of Christendom instead of to the Pope; an expedient which as soon as the King was informed of, he exclaimed with an oath, "That man has the sow by the right ear." The author of the proposal was immediately sent for to court, made one of the royal chaplains, and rewarded with other ecclesiastical preferments. The following year he went abroad to manage the scheme which he had suggested of consulting the universities and the most learned divines; and on this commission he traversed a considerable part of France, Italy, and Germany. In the latter country he contracted at Nuremberg a second marriage with Anne, the niece of the wife of Osiander, an eminent protestant divine. There can be no doubt indeed that Cranmer's mind was by this time quite made up in favour of several of the most fundamental articles of belief maintained by the reformers—especially their denial of the necessity of celibacy in the clergy, and of the supremacy and dispensing power claimed by the Bishop of Rome. He had probably already formed the plan of employing his best endeavours to establish the Reformation in England. While he was still abroad the archbishopric of Canterbury became vacant in August, 1532, and the King immediately nominated him to the see, and commanded him to return home. On the 23d of May, 1533, he pronounced the sentence of divorce between Henry and Queen Catherine; and on the 28th of the same month he publicly confirmed the marriage which the King had previously contracted with Anne Boleyn. He now exerted himself strenuously to forward every innovation in the discipline of the church which tended to weaken the strength of its existing constitution; and in this spirit both the translation of the Scriptures and the dissolution of the monasteries were promoted by him with great zeal. So long as Henry lived, however, he dared not attempt any direct change in the articles of religion. He was also during the whole of this reign obliged to keep his marriage a secret; and in 1539, on a statute (commonly called the Act for the Six Articles) being passed in parliament, notwithstanding his anxious opposition, enforcing among other things the celibacy of the clergy, he deemed it safest to send back his wife to Germany. After the accession of Edward VI. his power was much more unrestrained; and he exerted it so as to effect the thorough reform of the church both in discipline and in doctrine. On the death of Edward, Cranmer was induced, but not till after many importunities, to follow the example of all the other members of the Privy Council, and to sign the instrument declaring the crown to have fallen to Lady Jane Grey. After the failure of the attempt to accomplish this settlement, the share which he had thus reluctantly taken in the affair was gladly made the pretence for destroying so formidable an enemy as he was likely to prove of that restoration of the old religion which was now contemplated. Accordingly, being brought to trial, he was found guilty of high treason; on which the revenues of his archbishopric were immediately sequestrated. Having, however, acknowledged his offence, and earnestly petitioned for mercy, he received her majesty's pardon. But this show of clemency was only intended to prepare the way for his ruin on a still more odious charge. On the 20th of April, 1554, he was brought along with Ridley and Latimer before commissioners appointed by the Queen, and after a short examination condemned with them as a heretic. It was found, however, that in consequence of the Pope's authority not being yet re-established in England, this sentence was void in law; and Cranmer was therefore retained in custody till the 12th of September, 1555, when he was again brought up before a commission which sat in St. Mary's Church, Oxford. The result was, that he was commanded to appear at Rome to defend himself within eighty days;—a cruel mockery of justice, inasmuch as, even had he been disposed to trust his cause to the decision of the Pope, he had no power of repairing to the appointed tribunal, being kept all

the while in close confinement. At the end of the assigned period he was condemned as contumacious, and was immediately subjected to the ceremony of degradation, which was performed by Bishops Bonner and Thirlby. Dressing the old man in archiepiscopal robes made of coarse canvas, they then stript them off him, piece by piece, and put on in their stead a thread-bare yeoman's gown, and a common cap. He was then remanded to prison. But the malignant ingenuity of his persecutors was not yet satisfied—they hoped to dishonour their victim still farther before consigning his body to the flames. In this view they assailed him by the most incessant and artful importunities, till they at length succeeded in their object of prevailing upon him to sign a recantation of his alleged errors, on an assurance that his life should be saved. No sooner had they obtained what they desired, than the paper was printed, and every where dispersed about. Meanwhile, on the 14th of February, an order was issued for the execution of the now doubly unfortunate man on the 21st of the following month. On that day, accordingly, he was brought first into St. Mary's Church, and there placed upon an elevated stage or platform opposite to the pulpit. Being called upon to repeat his confession, he expressed instead, with floods of tears, his penitence for the shameful weakness which had allowed it to be extorted from him. He was then led in haste to the spot intended for his execution, over against Baliol College. Here being stript to his shirt, and having his shoes taken off, he was tied to the stake, and the fire lighted. He held out his right hand steadily all the while, amidst the keenest of the flames, often repeating "This unworthy hand," in allusion to his recantation, which it had subscribed. The last words which he uttered were, "Lord Jesus, receive my spirit!" which he ejaculated oftener than once, looking up beseechingly to heaven.

[Portrait of Cranmer.]

Steam-Engines.—Engineers estimate the force of steam-engines by a measure which they term the horse-power. This power is the force required to raise or move 528 cubic feet of water, which weighs 33,000lbs., through one foot of space per minute. The power of a man may be assumed equal to that of raising 60 cubic feet, which weighs 3750lbs. avoir., through the space or height of one foot in a minute, or a proportionate weight to any other height, so that the height multiplied by the weight may give the product 3750lbs. A stout labourer will continue to work at this rate during eight hours per day*. A day's labour of a man working thus continuously may therefore be reckoned at 28,800 cubic feet of water being raised one foot high; and in this proportion a one-hundred-and-fourteen-horse power is equal to the power of about one thousand men. The horse-power of the steam engine, thus assumed, is beyond the usual power of an ordinary horse, a two-horse power being equal in reality to that of three horses. For instance, the power of a ten-horse steam-engine is equal to the force exerted by fifteen horses acting together; and if the engine work night and day, while each horse can only work during eight hours out of the twenty-four, it will really perform the work of forty-five horses; for it would require that number of horses to be kept to execute the same quantity of work. Any statement of the comparative cost of steam, horse, and manual labour, can be, of course, only an approximation to the truth, as this cost must necessarily depend on the prices of fuel consumed by steam-engines, and on the expense of their wear and tear, of the keep of horses, and of the wages of manual labour—all of which vary with circumstances, and that not in a relative proportion. Data for ascertaining this point have been given by different writers. It is estimated that a heavy horse, working ten hours, will consume 15lbs. of oats and 14lbs. of hay in the course of the day. An engine of thirty horse power, working ten hours, will consume about 2952lbs.; or, as nearly as possible, one chaldron of Newcastle coals.

* Farey on the Steam-Engine.

THE FIRST MILD DAY OF MARCH.

It is the first mild day of March;
Each minute sweeter than before,
The red-breast sings from the tall larch
That stands beside our door.

There is a blessing in the air,
Which seems a sense of joy to yield
To the bare trees, and mountains bare,
And grass in the green field.

My sister! ('tis a wish of mine)
Now that our morning meal is done,
Make haste, your morning task resign,
Come forth and feel the sun.

Edward will come with you, and pray,
Put on with speed your woodland dress;
And bring no book: for this one day
We'll give to idleness.

No joyless forms shall regulate
Our living calendar.
We from to-day, my friend, will date
The opening of the year.

Love, now an universal birth,
From heart to heart is stealing,
From earth to man, from man to earth,
It is the hour of feeling.

One moment now may give us more
Than fifty years of reason:
Our minds shall drink at every pore
The spirit of the season.

Some silent laws our hearts will make,
Which they shall long obey:
We for the year to come may take
Our temper from to-day.

And from the blessed power that rolls
About, below, above,
We'll frame the measure of our souls:
They shall be tuned to love.

Then come, my sister! come, I pray,
With speed put on your woodland dress;
And bring no book: for this one day
We'll give to idleness.

Wordsworth.

*** The Office of the Society for the Diffusion of Useful Knowledge is at 59, Lincoln's-Inn Fields.

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